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METHOD FOR DETECTION AND ESTIMATION OF DAMAGE IN COTTON YARN AND CORDAGE DUE TO MICRO-ORGANISMS

(First Revision)

UDC 677·21·072/·073 : 677·019·381

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 3

August 1986

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METHOD FOR DETECTION AND ESTIMATION OF DAMAGE IN COTTON YARN AND CORDAGE DUE TO MICRO-ORGANISMS

(First Revision)

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METHOD FOR DETECTION AND ESTIMATION OF DAMAGE IN COTTON YARN AND CORDAGE DUE TO MICRO-ORGANISMS

(*First Revision*)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 15 October 1985 after the draft finalized by the Chemical Methods of Test Sectional Committee had been approved by the Textile Division Council.

0.2 This standard was first published in 1961 and has been revised with a view to make the standard up-to-date on the basis of the experience gained. In the revised standard, the breaking strength test has been omitted since the test itself will not give any clear indication of microbial attack. Breaking strength test has been replaced by microscopic extrusion test which is well established and reliable. A method of examination under ultraviolet lamp for the damage caused by micro-organisms has been included. Preliminary tests for detection of micro-organisms have been deleted because inhaling of bacteria is harmful to the health of the operator especially when this is repeatedly done. Determination of *p*H of the aqueous extract is also deleted as this does not give reliable information.

0.3 Cotton yarn and cordage are liable to be attacked and damaged by micro-organisms, such as bacteria and fungi, while in transit, in storage or in use (*see* Fig. 1, 2, 3 and 4). The deterioration is promoted by climatic conditions prevalent in tropical and subtropical countries.

0.4 Moisture is essential for the development and growth of micro-organisms, the amount of moisture required being dependent upon the type of organism. Thus fungi usually develop when the relative humidity of the environment approaches about 75 percent, and the growth is rapid when the relative humidity is above 85 percent. Bacteria, on the other hand, are active only when the substrate on which they are present is itself wet.

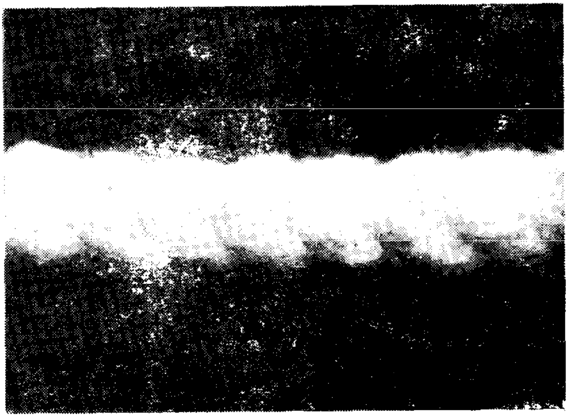

Fig. 1 Undamaged Cotton Cordage

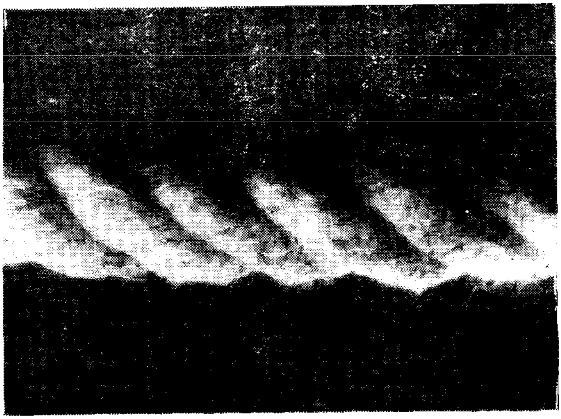

Fig. 2 Cotton Cordage Showing Fungal Damage

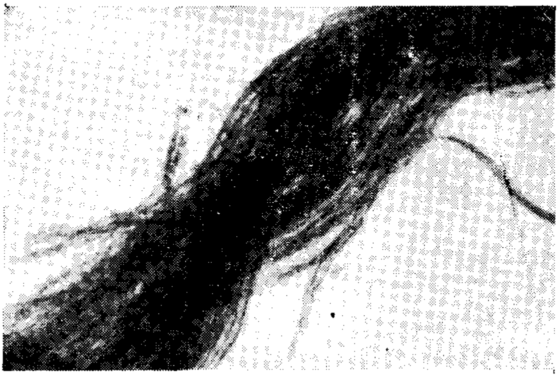

FIG. 3 UNDAMAGED COTTON YARN

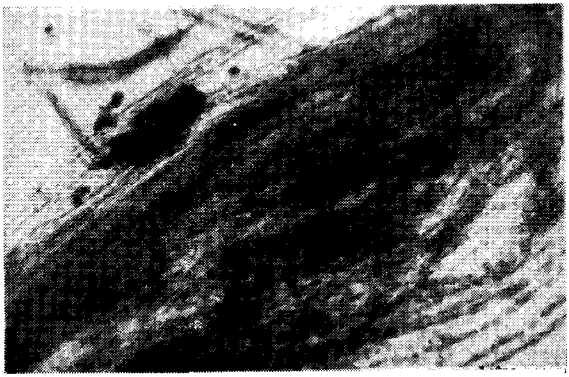

FIG. 4 COTTON YARN SHOWING FUNGAL DAMAGE

0.5 Fungi may appear as fine downy growth or as dark spots or stains causing discolouration of yarn or cordage as the case may be. The isolated regions of mould growth may show considerable tendering while the rest of the material (except when not weathered outdoors) may indicate little or no tendering. If the yarn or cordage had been in contact with soil or had been contaminated with it and then exposed to dampness, the entire material may show rapid and uniform tendering.

0.6 The degree of growth of micro-organisms as well as their tendering effect may differ widely even in the immediate neighbouring areas in the yarn or cordage. It is, therefore, not feasible to submit the results of tests prescribed in this standard to statistical analysis.

0.7 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated is to be rounded off, it shall be done in accordance with IS : 2 - 1960*.

1. SCOPE

1.1 This standard prescribes a method for the detection and estimation of damage in cotton yarn and cordage due to micro-organisms.

2. SAMPLING

2.1 Lot — The quantity of cotton yarn or cordage purporting to be of one definite type and quality delivered to a buyer against one despatch note shall constitute a lot.

2.2 Sample for the test shall be selected so as to be representative of the lot. Samples drawn in accordance with the material specification or as agreed to between the buyer and the seller shall be taken as representative of the lot.

2.3 The sample shall be first visually examined against light for the presence of microbial growth like isolated dark portions, stains or discolouration; all the portions showing microbial growth shall be clearly marked.

2.4 The sample shall also be examined under an ultraviolet lamp having a *Blackwood* filter with peak output at 365 nm for the presence of any flourescent spots which shall be clearly marked.

NOTE — The presence of fluoresence is always not related to the microbial attack or the absence of it does not exclude the possibility of microbial attack.

3. TEST SPECIMENS

3.1 From the marked portions of the yarn or cordage draw at random 10 pieces each not less than 10 cm long. These shall constitute the test specimens for the purpose of **5.1.1**, **5.1.2** and **6.1.1**. Keep the test specimens in a humid chamber (*see* Note) with relative humidity above 85 percent at room temperature for 8 to 10 days. (For a humid chamber a large desiccator with water kept at the bottom may suffice.)

---

*Rules for rounding off numerical values (*revised*).

Note — If the marked portion as in **2.3** and **2.4** of the sample in the lot is showing visible patches of stains or discolouration, the specimens drawn as in **3.1** may be directly studied as in **5.1.1** without keeping in a humid chamber.

4. REAGENTS

4.1 Quality of Reagents

4.1.1 Unless specified otherwise, 'pure chemicals' shall be employed in the tests and distilled water (*see* IS : 1070-1977*) shall be used where the use of water as a reagent is intended.

Note — ' Pure chemicals ' shall mean chemicals that do not contain impurities which affect the test results.

4.2 The following reagents shall be used.

4.2.1 *Lactophenol Solution* — prepared by dissolving 100 g phenol in 100 ml water and adding 100 ml each of glycerine and lactic acid to the solution.

4.2.2 *Cotton Blue Solution* — prepared by making a saturated solution (about 25 ml) of *cotton blue* (old colour Index number 707) (new colour index number 51190) in 95 percent alcohol and adding 10 ml of glycerine and 80 ml of water to 10 ml of this solution.

4.2.3 *Cotton Blue-Lactophenol Solution* — prepared by mixing equal volumes of saturated aqueous cotton blue and lactophenol solutions.

4.2.4 *Sodium Hydroxide* — (18 percent *m/v*) prepared by dissolving 18 g sodium hydroxide pellets in 80 ml distilled water, allowing it to cool and finally making the volume to 100 ml.

4.3 Apparatus

4.3.1 Microscope with magnification range of 50 to 500.

5. DETECTION OF DAMAGE

5.1 Procedure

5.1.1 Unravel five to six yarns or cordage from the test specimens as drawn in **3.1**. Tease them gently on a glass slide to separate individual fibres. Treat the fibres with a few drops of cotton blue-lactophenol solution for 1 to 2 minutes. Remove the colour from the surface of the fibres by treating them with lactophenol solution. Prepare at least 10 slides from these fibres.

5.1.2 Take a slide and examine it under a microscope at 100 to 500 magnification and compare the fibres with the undamaged fibre (*see* Fig. 5). Presence of the following signs indicates that the fabric has been damaged by microbial attack:

a) incisions or cracks on the cuticle of the fibre (*see* Fig. 6);

---

*Water for general laboratory use (*second revision*).

b) damage to primary and secondary walls of the fibre from cuticle inwards (*see* Fig. 7);

c) hyphae within the lumen (*see* Fig. 8); and

d) indentation or serrations of the fibres from the cuticle inwards, that is, towards the lumen (*see* Fig. 9 and 10).

5.1.3 Similarly examine other slides.

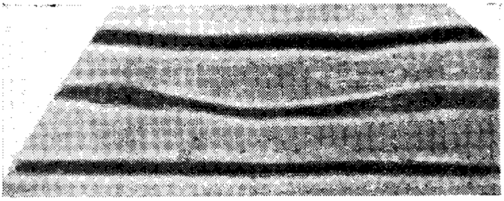

FIG. 5 UNDAMAGED COTTON FIBRE

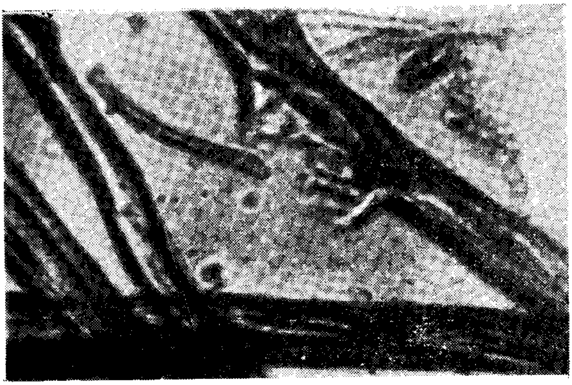

FIG. 6 COTTON FIBRE SHOWING INCISIONS OR CRACKS ON ITS CUTICLE

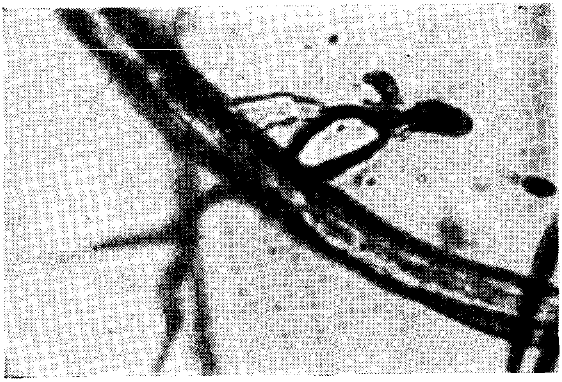

FIG. 7 COTTON FIBRE SHOWING DAMAGE TO ITS PRIMARY AND SECONDARY WALLS FROM THE CUTICLE INWARDS

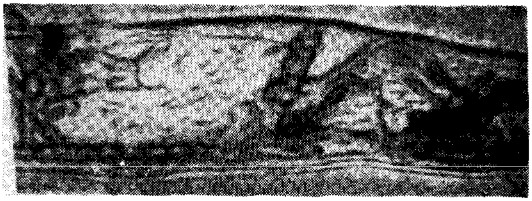

FIG. 8 COTTON FIBRE SHOWING FUNGAL INFECTION — HYPHAE AND SPORES INSIDE AND LUMEN

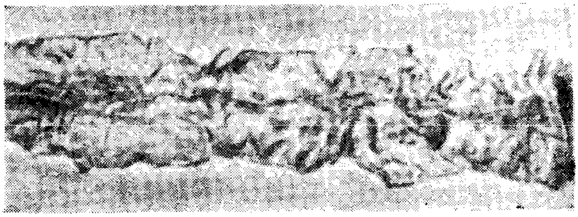

FIG. 9 COTTON FIBRE SHOWING MODERATE BACTERIAL DAMAGE

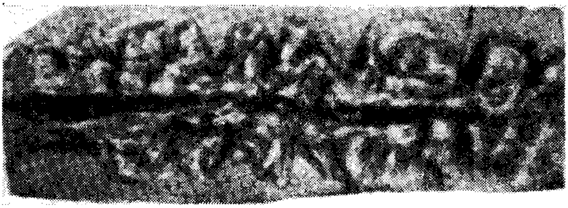

FIG. 10 COTTON FIBRE SHOWING SEVERE BACTERIAL DAMAGE

6. EXTENT OF DAMAGE

6.1 Procedure

6.1.1 *Extrusion Test* — Take one test specimen as drawn in **3.1** and prepare the individual fibres as in **5.1.1.** Take a clean glass slide and place a drop of 18 percent NaOH on it. Place a bundle of fibres on a linoleum pad and cut off a small portion of the fibres approximately 0·2 mm in length with a sharp blade. Immerse the cut fibres in the alkali for about 60 seconds and examine under the microscope at 250 magnification and note down the number of dumbell shaped, funnel shaped and extrusionless fibres. Examine about 300 fibres and 10 slides in all.

6.1.2 Undamaged fibres show dumbell shape, and damaged fibres swell width-wise without showing any characteristic dumbell shape; some damaged fibres show roughly funnel shaped ends.

6.1.3 Fibres of 0·2 mm length can be conveniently cut with the help of two razor blades held together by a holder and then cutting the specimen, the fibres in between the two blades to be taken for examination.

6.1.4 Mechanically damaged fibres also do not show any characteristic dumbell shape and may add to the damage due to microbial attack, but their contribution to damage is negligible.

6.2 Calculate the percentage of dumbell shaped (a) funnel shaped (b) and extrusionless fibres (c) as examined in **6.1.1.** Obtain the quality figure as follows:

$$\text{Quality figure} = \frac{(a)}{1} + \frac{(b)}{2} + \frac{(c)}{3}$$

6.2.1 If a quality figure in **6.2** is less than 75, then report the sample as damaged. The quality figure may also include damage due to mechanically damaged fibres.

7. REPORT

7.0 The report shall include the following information :

a) Type of material,

b) Damaged/undamaged, and

c) Number of specimens tested.

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